REMARKS :

Concerning section 4:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference. With all respect, the discussion of the photoactivation of isomeric nuclides is related to the current claim language in the sense that it explains why the Indium isomer nuclide photoactivated by an accelerator with a KV from 100 keV to 2 MeV did not allow Mrs cauchois in [10] to detect a variable half life in the deexcitation of such a metastable isomer. The photoactivation gateways art is presented for example in the following documents:

[8] Firestone R. et al., "*Table of Isotopes*", Eighth Edition, 1996, Wiley Interscience.

[9] Pontecorvo B., and Lazard A., "*Nuclear Isomerism produced by X-rays of the continuous spectrum*", Compte Rendus, French Academy of Sciences, 1939, pp. 99-101.

[10] Boivin M., Cauchois Y., and Heno Y., "*Nuclear photoactivation of 77Se, 107,109Ar, 111Cd, 115In, and 199Hg*", North-Holland Publishing Co., Amsterdam, Nuclear Physics, A137 (1969), pp. 520-530.

[11] Veres A., "*Photo-activation if Cadmium-111m and Indium-115m by Cobalt-60 irradiation*", International Journal of Applied Radiation and Isotopes, 1963, Volume 14, pp. 123-128, Pergamon Press Ltd.

These documents explain a posteriori, when considering the groups two gamma produced in a cascade by a Cobalt 60 source, why it produces only a slight variation in the half life of the metastable state of Indium, and why a 6 MeV cLINAC can photoactivate Indium using certain gateways resulting in a high variation in the half life of the metastable state of Indium: indeed, only the gateways of 1078 keV and 1486 keV have a significant yield in photoactivation. Hence, a group of entangled gamma is likely to photoactivate indium only if their energy is high enough as compared to the photoactivation gateways.

Referring to [9], [10], and [11], photoactivation gateways are very well understood in the art, and can be seen for Indium 115 in the diagram below:

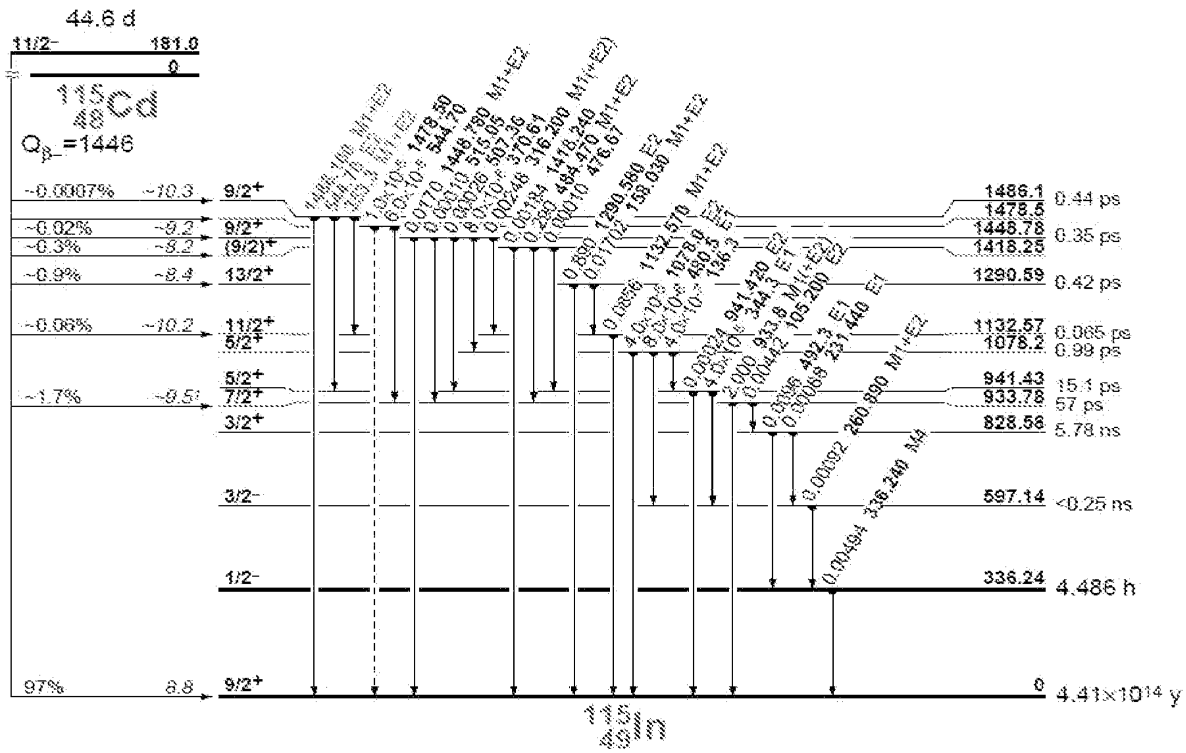

Diagram of the metastable levels of Indium 115 (from document [8])

However, the cLINAC having a KV of 6 MeV, produces a well known spectrum of gamma with the maximum number of gamma around 1.5 MeV, thus allowing for groups of two or more entangled gamma to photoactivate the indium isomer nuclide via the gateways having the higher yields.

This is perfectly in lines with our experimental data.

<u>Concerning section 5:</u>

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference.

I acknowledge that the invention is about the variable half-life of a characteristic energy line of an isomer nuclide; however, nothing in the claim language prohibits the mixing of other isomer nuclides having different characteristic energy lines.

Unfortunately, the Physics Reports from Genovese M. is limited to the entanglement of visible photons, which may differ from the entanglement of the nuclei of an isomer nuclide, which is obtained by photoactivation with high-energy photons of the order of 1.5 MeV. However, there are some recent experiments reported about the entanglement of solid-state material, which may provide some of the clues concerning the transfer of entanglement to solid-state material:

[12] Togan E. et al in Nature, Volume 466, 5 August 2010, page 730-735: "Quantum entanglement between an optical photon and a solid-state spin qubit" [Refer to appendix D]

Togan states that photon entanglement can be transferred in solid-state materials such as diamond, having nitrogen-vacancies (NV) of the crystal lattice: "*The nitrogen-vacancy (NV) centre, a defect in diamond consisting of a substitutional nitrogen atom and an adjacent vacancy, is a promising candidate for implementing a quantum node*". Hence, the academic community no longer rule out entanglement of solid-state materials. Consequently, the entanglement of the nuclei of a metastable nuclide by photoactivation with gamma can no longer be ruled out.

I, and professor Van Gent, did carry out a number of experiments:

- Appendix A reports experiments of photoactivation carried out with a source of Cobalt 60;
- Appendix B reports carried out with a 6 MeV CLINAC;
- Appendix C is a report of these experiments in ArchivX.

The specification that I filed with professor Van Gent fully describes how to produce excited metastable isomer nuclides having a variable half-life. The results were published in [arXiv:nucl-ex/0411047v1] 5 months before filing the international application, describing the reduction-to-practice of the invention. Hence, it is believed that one skilled in the specific art of the invention, when considering the complete file, would consider its credibility to be more likely established than not.

<u>Concerning section 6:</u>

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference.

I, and professor Van Gent, have been photoactivating isomer nuclides at the time of the invention. Photoactivating an isomer nuclide foil is a macroscopic process not requiring

the kind of sophisticated optical apparatuses and set-up usually associated with the measurement of the entanglement of visible photons. However, the apparatuses required photoactivate isomer nuclide, and to measure the characteristic lines of energy are very expensive, and only available in large universities, or industries, usually in different laboratories working, or operating, on unrelated subjects. The current invention is not difficult to implement when one has access to a cLINAC for experimenting, and also access to a laboratory with measurement apparatuses, which fortunately was the case as Professor Van Gent was a radiation safety officer (RSO), knowing how to operate the two types of required equipment for the above reduction-to-practice. Any RSO having regular engineering skills that would read the specification could easily photoactivate an isomer nuclide foil in a cLINAC (provided that he has access to such an equipment), and then measure the characteristic line of energy in a Canberra high purity intrinsic Germanium gamma counting system enclosed in an Orthec low level background shield made of lead, copper and steel (provided that he has access to such an equipment), and compute the variable half-life over 100 minutes segment using the log count and a linear regression.

There are absolutely no difficulties with “identification of individual measurement object and timing”, nor a need for “a method of controlling a remote desexcitation of an excitation by gamma rays”, nor for identifying a “specific isomeric nuclei”.

Nothing in this procedure described in the specification is out of the skill of a RSO, and there is no room for undue experimentation in setting up such measurements. It is to be noted that the one skilled in the art is supposed to take into account the specification in carrying out the invention, and moreover, the jurisprudence even allows for different persons skilled in different arts to carry out the invention when different steps are involved, which is the case in this very specific instance. Hence, the person skilled in the art could even rely on different operators for operating the above equipment as a cLINAC and a Canberra detector are quite different to operate.

For all the above reasons, and because some objections cannot hold when considering the detailed subject matter of the specification, it is believed that one should be satisfied with the specification that the invention is sufficiently enabled by the disclosure considering the extraordinary cost of operating the equipment involved.

Concerning section 7:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference, and also to the argument provided above concerning section 4, 5 and 6 which shows that the credibility if the invention is more likely than not.

Concerning section 8:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference, and also to the argument provided above concerning section 4, 5 and 6. Said arguments show that the credibility of the invention is more likely than not. It follows that the invention is operative, more particularly in view of appendix B. Utility of the invention follows as modifying the half-life of metastable nuclides is useful, in particular in applications where an initially rapidly decreasing radiation dose (with a rate higher than the regular half-life of the isomer nuclide) is preferred in order to limit the overall dose, such as in scintigraphy.
It also follows that one skilled in the art clearly would know how to use the claimed invention, by applying the teachings of the specification, which complies to 35 USC 112 first paragraph. Thus, claims 43-69 comply with 35 USC §112 first paragraph.

Concerning section 9:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference, and also to the argument provided above concerning section 4, 5 and 6. Said arguments show that the credibility of the invention is more likely than not. It follows that the invention is operative, more particularly in view of appendix B.
Thus, claims 43-69 comply with 35 USC §101 being for new and useful compositions of matter and processes, which do not lack utility.
It also follows that one skilled in the art clearly would know how to use the claimed invention, thus claims 43-69 comply with 35 USC §101.

Concerning section 10:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference, and also to the argument provided above concerning section 4, 5 and 6. Said arguments show that the credibility of the invention is more likely than not. It follows that the invention is operative, more particularly in view of appendix B. Hence, the claim

subject matter, which is in line with the specification can be made and/or used by the one skilled in the art to which it pertains, or with which it is most nearly connected. Thus, claims 43-69 comply with 35 USC §112.

Concerning section 11:

I refer to the letter filed 9/20/2010, the arguments of which are incorporated here by reference, and also to the argument provided above concerning section 4, 5 and 6. Said arguments show that the credibility of the invention is more likely than not. It follows that the invention is operative, more particularly in view of appendix B. The metes and bounds of the claimed invention are precise, and well defined due to the support by the enabling disclosure, rendering the claims finite, more specifically for the reasons already stated in the letter filed 9/20/2010 at the paragraph "*Concerning the breadth of the claims*" and "*Concerning the method to irradiate by using the product according to the invention as a transient irradiation source*", which have lead us to redraw the claims, thus particularly pointing out and distinctly claiming the subject matter, which is regarded as the invention that I, and professor Van Gent made a long time ago, and for which , we seek the protection offered by the United States of America constitution in the following terms: "*To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries*".